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ABSTRACT

Job Literacy Analysis (JLA) is a systematic, comprehensive process for identifying the literacy requirements of jobs. It examines materials used for real tasks in real jobs and provides data about the materials used in jobs, tasks performed using them, and skills required to perform the tasks. Researchers reviewing the materials and tasks infer required literacy skills. An advisory committee reviews the results. Eighteen JLAs have identified 140 skills and grouped them into 23 categories: quantitative (8 categories), document (5), prose (4), identification, computer-related skills, following directions, synthesizing, contingent decision making, and writing. Some literacy skills are the same as general adult literacy skills, some are similar to them, and some are newly-identified skills. Further analyses have explored the possibility of describing jobs using the skills and skill categories revealed by job literacy analysis. The initial analysis looks at complexity as a descriptor of the literacy skills required by jobs. Six potential complexity measures have been studied. Results show that 50 percent of the literacy skills needed on jobs are the same as general adult literacy skills. The exploration of job literacy complexity encourages further effort to describe jobs in terms of literacy demands. (Appendixes include the list of job literacy categories of skills, list of newly identified skills, and comparison of complexity measures of four jobs.) (YLB)

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Job Literacy: A Framework for Categorizing Skills and Assessing Complexity

Job Literacy Analysis is a systematic and comprehensive process for identifying the literacy requirements of jobs. Literacy is defined as any material - driven process; a material consists of printed matter or objects with words or numbers on them, such as gauges or control panels. This paper presents an empirically-based list of skills built from the workplace, and a categorization of the skills. The skill categories and skills list are used to compare the job literacy skills identified to date with general adult literacy skills. A further analysis explores complexity as a descriptor of the literacy required by jobs.

Skills and Skill Categories

The result of the 18 Job Literacy Analyses completed to date is an empirically-based list of skills. The list will be refined and extended using a data base being built as more jobs are analyzed. Currently, data have been collected for an additional 11 jobs. The jobs analyzed range across four Bureau of Labor Statistics/Department of Labor job clusters. The data were collected in 43 different settings across a broad geographical area of the U.S.

The 18 jobs analyzed include: in the service cluster: food service worker, nurse assistant; in the administrative support cluster: entry-level secretary, mid-to-executive secretary, customer service representative, clerical cluster, warehouser, document processor, shipping/receiving; in the operators, fabricators and laborers cluster: press operator, production A operators (more technical), production C operators (cartons, packaging), production D operators (mostly manual labor), crushing and mixing machine operators and tenders, sanitation; in the precision production, craft and repair occupations: quality control, maintenance, stationary engineer.

Job Literacy Analysis (Norback et. al., 1990, 1991, 1994) examines materials used for real tasks in real jobs. It provides data about the

materials used in jobs, the tasks performed using the materials, and the skills required to perform the tasks. Job incumbents provide examples of the most important materials they read and use on the job, explain how they use the materials, and rate the materials' importance to their job. For example, entry-level secretaries gave interviewers examples of reports and newsletters (material). One of the tasks they performed using the reports was "making an initial check for correctness and completeness."

Required literacy skills are inferred by researchers reviewing the materials and tasks. For example, the material and task described above require the skills of applying the rules of grammar, recognizing words needing capitalization, applying rules for punctuation, spelling common words correctly, and using references to check and correct spelling errors. A task that requires looking across materials was provided by document processors: job incumbents used correction stubs, a code list, and a computer file to do the following tasks: a) type the information the candidates provide on the correction stub into a computer file,; b) verify the codes used on the stub against the code list; and c) scan the CRT to verify the information entered. The skills required to process these materials for this task include transferring data from a source (forms, gauges, scale) into a computer program; reading and responding to computer commands, and reading and understanding abbreviations, contractions, and acronyms. Blind quality control checks are made regularly during the skills identification process. Raters are given feedback to enhance inter-rater reliability.

An Advisory Committee of supervisors reviews the results. The advisory committee checks to see if any important material, task or skill is missing. In most cases they have corroborated the information provided by the workers. An example of a change in the analysis of document processor was the addition of the skill of reading and understanding foreign dates.

A total of 140 skills were identified by this process. Once the 140 skills had been identified, they were categorized in order to make them useful. There is no single most useful way of categorizing job literacy

skills. The categorization reported here focusses on the problem of planning instruction, with the end goal of enhancing student learning. One function of the current categorization is to facilitate the development of adult education and high school curricula that embody core sets of skills across jobs. The categories define potential teachable units that educators and trainers can use to build basic skills training based on realistic and practical job materials and tasks.

Table 1 presents the 23 categories of job literacy skills. Quantitative, Document and Prose are categories previously used to describe the skills of general adult literacy (Educational Testing Service, 1991). The remaining categories were needed to account for the full range of material-driven processes observed. The classification permits comparison of the skills and categories with the range of skills that have been identified previously in general adult literacy. Which literacy skills required in real jobs are the same as general adult literacy skills, which job literacy skills are similar to the general adult literacy skills, and which are newly-identified skills?

Insert Table 1 about here

Exact matches between job literacy skills and general adult literacy skills (prose, document, and quantitative) include: a) Multiplying and/or dividing fractions (in the category of Multiplying and/or Dividing), b) Locating and using parts of a schematic (in the category of Processing Illustrations), and c) Underlining or circling a portion of the text (in the category of Reading). All of the skills in the following five job literacy categories were exact matches with general adult literacy skills: Formulating; Processing Forms; Processing Illustrations; Processing Tables; Processing Graphs, Pie Charts and Bar Charts. Part of the skills in the following four categories were exact matches: Adding and/or Subtracting, Multiplying and/or Dividing, Other Arithmetic Processes, and Reading. A total

of 65 of the 140 job literacy skills (46 percent) were exact matches with general adult literacy skills.

The following skills are similar to skills of general adult literacy: a) Counting by intervals of one, two, five or ten (in the category of Numbers and Counting); b) Reading and understanding dates and days of the week (in the category of Telling Time); and c) Rounding integers and decimals (in the category of Multiplying and/or Dividing: Estimating). The skills in five job literacy categories were similar to general adult literacy skills: Numbers and Counting; Telling Time; Vocabulary; Grammar, Editing and Spelling; and Writing. Some of the skills in the following four categories were similar: Adding and/or Subtracting, Multiplying and/or Dividing, Other Arithmetic Processes, and Reading. A total of 38 of the 140 job literacy skills (or 27 percent) were similar to general adult literacy skills.

Some job literacy skills are newly-identified: they are not the same or similar to general adult literacy skills. Examples of these skills include: a) following very specific step-by-step directions to perform a sequence of tasks, in the category of Following Directions; b) synthesizing information from more than one source (e.g., written, pictorial, oral) to complete a task, in the category of Synthesizing; and c) determining the appropriate course of action in a particular "if-then" situation, in the category of Contingent Decision-Making. All of the skills in the nine following categories are newly-identified: Linear, Weight and Volume Measures; Scales and other Gauge Measures; Selecting; Reference; Identification; Computer-Related Skills; Following Directions; Synthesizing; and Contingent Decision-Making. Part of the skills in the Reading category of skills were newly-identified. Overall, a total of 37 of the 140 job literacy skills (or 26 percent) were newly-identified. They are shown in Table 2.

Insert Table 2 about here

Let us examine a little more closely three examples of the newly-

identified skills listed above. The Following Directions skill was identified in the job of food service worker, for example, when job incumbents used recipes (material) in the task of "read(ing) and follow(ing) directions to prepare items." This involves more than the reading of a list; the order of information being processed is critical to the fulfillment of the task. This job literacy skill requires a combination of reading and acting.

The Synthesizing skill is apparent in the mid-to-executive level secretary job. In one example, the job incumbent "arranges for meetings with multiple participants" (task) by using diaries, appointment books, and calendars (material). Several materials or types of information, such as the different materials mentioned above, need to be referred to while the secretary gathers information verbally from several people. Then the secretary decides what to do next, and does it (i.e., in this case, schedules the meeting on the appropriate day).

The Contingent Decision-Making skill was required in the job of stationary engineer, in which the job incumbent had responsibility for maintaining the power plant at a manufacturing site. The engineers were required to use an instrumentation/control panel (material) to "monitor/control systems by responding to readouts on computer screens" (task). In this situation, incumbents are given information and must decide, based on that information meeting other criteria, whether or not to perform a specific action. This job literacy skill requires a combination of reading, judging and acting.

These are three examples of the 37 newly-identified job literacy skills. These are all skills that could only be identified by examining real jobs, real job materials, and real job tasks.

Job Literacy Complexity

Further analyses have explored the possibility of describing jobs using the skills and skill categories revealed by job literacy analysis. The initial analysis looks at complexity as a descriptor of the literacy required by jobs. What makes the literacy required by a job complex? Possible

contributors to complexity include the materials that must be used, the tasks, and the skills necessary for material-task combinations. Six potential complexity measures were studied. Some jobs may be more complex than others on all or most of the measures. Or, patterns may exist that suggest job literacy complexity is not a unidimensional concept. The six complexity measures are:

1) Number of skills. The number of the skills was counted for each job.

2) Number of skill categories. The number of skill categories was counted for each job.

3) Number of categories of materials. An example of a category is logs; an example of materials is a particular log provided by incumbents. The variable is the number of categories of materials used in a job.

4) Average number of tasks per category of material. Job incumbents described the specific tasks that they performed using particular materials. For example, entry-level secretaries alphabetized (task) the entries in a directory or organizational chart (category of material) and proofread (task) agendas (category of material). This variable reflects the average number of tasks performed per category of material.

5) Total number of material-related tasks. The total number of material-related tasks results from multiplying the average number of tasks per category of material by the number of categories of materials. This variable reflects the total number of tasks in the job that involve the use of any kind of material.

6) Number of structures within materials. A structure is a format used to organize information in a particular document. Kirsch and Mosenthal (1989 to 1991) identified eight different kinds of structures, including graphs, charts, diagrams, prose, simple lists (a list of items and a label) and nested lists (lists which intersect other lists). A given type of material will include one or more structures. For each job studied, the number of structures within materials was counted.

This paper compares the complexity measures of four jobs: food service worker, nurse assistant, entry-level secretary, and mid-to-executive level secretary. The results are summarized in Table 3.

Insert Table 3 about here

Discussion

Earlier work (e.g., Sticht and Mikulecky, 1984; Mikulecky et. al., 1994) has shown that it is critical to have job-related materials and tasks incorporated in training in order to get transfer of the skills from the classroom to the workplace. Training with high functional context is necessary for the learner/worker to apply on the job the skills learned in training. The findings of this study suggest approaches to achieving high functional context into both general adult literacy instruction and job-specific literacy training.

Fifty percent of the job literacy skills identified in this paper are the same as general adult literacy skills. Functional context in relation to these skills can be provided by incorporating job-related materials and tasks into general adult literacy training.

A portion of the literacy skills needed on jobs -- those termed "newly identified," and some of those termed "similar" -- are unlikely to appear in general adult literacy training. Teaching these skills to workers requires training that focuses on newly-identified skills and that incorporates job-related materials and tasks. It is important to note that the newly-identified skills are among those stressed by employers for the workplace of the future (Secretary's Commission, 1992). Examples of these skills include following directions, contingent decision-making, synthesizing, and computer-related skills.

The exploration of job literacy complexity encourages further effort to describe jobs in terms of literacy demands, and suggests approaches to clarifying measures. For example, Variable 5 appears to differentiate among

jobs; the highest-ranking job on that variable has more than 4.5 times as many materials-related tasks as the lowest-ranking job. Variable 5 is a composite of variables 3 and 4; examination of the results for variables 3 and 4 indicates that the variance is contributed by the number of tasks per category of material rather than by the number of categories. Other measures appear to have some ability to differentiate, and three of the five non-composite variables rank the jobs in the same way. Some implications for training are suggested. For example, when a job requires many tasks per material, trainees might practice many tasks per material, instead of few. Further analysis on a larger number of jobs using the data base being assembled by Norback and colleagues appears to be warranted.

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Table 1

Job Literacy Categories of Skills Identified to Date

Quantitative

1. Formulating
2. Adding and/or Subtracting
3. Multiplying and/or Dividing
4. Other Arithmetic Processes
5. Numbers and Counting
6. Telling Time
7. Measuring Skills: Linear, Weight and Volume Measures
8. Measuring Skills: Scales and other Gauge Measures

Document

9. Selecting
10. Processing Forms
11. Processing Illustrations (Pictures, Diagrams, Schematics, Maps)
12. Processing Tables
13. Processing Graphs, Pie Charts, Bar Charts

Prose

14. Reading
15. Reference
16. Vocabulary
17. Grammar, Editing, Spelling

18. Identification

19. Computer-Related Skills

20. Following Directions

21. Synthesizing

22. Contingent Decision-Making

23. Writing

Table 2

Newly-Identified Skills

Category: Selecting

1. Determine which form in a group of forms is of relevance to the problem.
2. Determine which graph or pie or bar chart in a group of graphs or charts is of relevance to the problem.
3. Determine which illustration in a group of illustrations is of relevance to the problem.
4. Determine which table in a group of tables is of relevance to the problem.

Category: Reading

5. Determine the main idea of a paragraph or several paragraphs.
6. Determine the main idea of a paragraph or several paragraphs which were written by a non-native English speaker.
7. Read and understand the main idea of a job-specific material.

Category: Reference

8. Use alphabetic and alphanumeric filing system (e.g., locating files).
9. Find information by using table of contents, index, appendix, glossary.
10. Find appropriate section of a reference source (e.g., sentence, paragraph, heading, table) to answer a specific question.
11. Find information by cross-referencing sources.
12. Determine the main idea of a reference material (e.g., passages, letters).

Category: Identification

13. Identify and label objects.
14. Identify objects by particular physical characteristics (e.g., size).
15. Select appropriate course of action by using taste, touch, sight or hearing.

Category: Computer-Related Skills

16. Locate and transfer (copy) data from a source (forms) into a CRT screen.
17. Locate information using a computer program.
18. Compare information using a computer program.
19. Create or generate information using a computer program.

20. Understand the operation of a computer keyboard.
21. Read and respond to computer commands.

Category: Measuring Skills: Linear, Weight and Volume Measures

22. Read and understand units of measure (e.g., U.S. standard, metric system).
23. Read and understand measures of weight (e.g., ounces, pounds, grams).
24. Read and understand measures of volume (e.g., pints, quarts, liters).
25. Read and interpret a linear scale (e.g., a ruler).
26. Read and interpret micrometers, calipers.

Category: Measuring Skills: Scales and Other Gauge Measures

27. Read and interpret the markings on a scale.
28. Calibrate a scale.
29. Read and interpret readings on test equipment.
30. Read and interpret a digital or computerized scale.

Category: Following Directions

31. Follow directions to complete a task that includes reading, identifying, observing and/or comparing.
32. Follow step-by-step directions to perform a sequence of tasks.
33. Follow directions to complete a task which includes arithmetic operations and/or counting (e.g., shipping/receiving).
34. Follow directions to complete a task which involves entering information into a CRT screen.
35. Follow directions to complete a task using a single illustration or a sequence of illustrations (pictures, diagrams, schematics, maps).

Category: Contingent Decision-Making

36. Determine appropriate course of action in a particular situation.

Category: Synthesizing

37. Synthesize information from more than one source (e.g., written, pictorial, oral) to complete a task.

Table 3

Job Literacy Complexity Measures

	Food Service Worker	Nurse Assistant	Entry-Level Secretary	Mid-to-executive level secretary
1. Number of skills required	48	56	71	74
2. Number of skill categories	15	12	12	12
3. Number of categories of materials	16	15	16	14
4. Number of tasks per category of material	3.1	2.5	11.5	16.5
5. Total number of material-related tasks	49.6	37.5	184.0	231.0
6. Number of structures within materials	28	42	46	48